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15MN51

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Mine Environment and Ventilation Engineering

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. A sample of mine air has the following volumetric composition :
O_2 – 19.81% , CO_2 – 0.92% , CH_4 – 1.02 % and N_2 – 78.25%. Calculate the composition by mass. What would be its composition (both by volume and mass) if they were saturated with water vapour at the sampling temperature of 303K and atmospheric pressure of 101.33 Kpa?   **(10 Marks)**

   b. Make use of Coward's diagram to comment on the Explosibility limits of CH_4 , H_2 and CO. Sketch Coward diagram for CH_4, H_2 and CO and state the applicability.   **(06 Marks)**

OR

2 a. The analysis of a sample of air from old workings is reported as follows : O_2 – 16.52% , CO_2 – 3.1% , CH_4 – 2.45% and N_2 – 77.93%. Calculate the percentage of air and black damp in the sample as well as the composition of Black damp.   **(10 Marks)**

   b. A mine producing 1000 ton of coal per day has a methane emission of $0.095 m^3$/s. Calculate the rate of ventilation required to keep down the level of methane in return gate at 0.7% if the intake air has a methane concentration of 0.2% and Indicate the degree of gassiness of mine.   **(06 Marks)**

Module-2

3 a. A fan ventilating a heading through a duct of 600mm diameter circulates $4 m^3$/s of air at the face. Calculate the heat added to the air by the fan , if the input power of the fan is equal to 2.9 kw.   **(08 Marks)**

   b. Interpret the effect of heat and humidity on the miner.   **(08 Marks)**

OR

4 a. A unit mass of air passing through a shaft with Barometric pressure 'B' , 'e' water vapor pressure and temperature 'T'. Determine the density of air 'ρ'.   **(11 Marks)**

   b. Calculate the density of air at a Barometric pressure of 101.325 Kpa and dry and wet – bulb temperature of 299K. Assume water vapour pressure as 2.6 Kpa.   **(05 Marks)**

Module-3

5 a. Prove that there is always a drop of pressure depending on the amount of frictional work along path of flow of a air.   **(10 Marks)**

   b. Calculate the pressure required for ventilating a given the following :

   width Height length
   Dimensions of drift = 2.5m × 3m × 300m
   Quantity passing = $300 m^3$/min.
   Coefficient of resistance = 0.0098 NS^2/m^4.
   Density of air = 1.2 Kp/m^3.
   Determine Darcy – Weisbach co-efficient for the same.   **(06 Marks)**

OR

6 a. A mine has three separate underground airways connected in parallel across the bottom of two shafts. Resistances of these airways are 100, 160 and 250 NS^2. If front – drift is 2000 pa, what quantity of air would flow i) through the whole mine   ii) through each split.

   (10 Marks)

   b. Explain the economics of designing a mine airway. **(06 Marks)**

Module-4

7 a. Determine the Natural ventilation pressure of a mine from thermodynamic consideration with P - V diagram. **(12 Marks)**

   b. Calculate the N.V.P from air density. **(04 Marks)**

OR

8 a. Sketch the characteristics of a centrifugal fan with i) Radial blade   ii) Forwarded blade   iii) Backward blade and compare the same. Explain Air power, Stall zone, Efficiency with respect to the sketch. **(08 Marks)**

   b. If R_A, R_B and R_C is the High, Medium and Low resistance of a mine. Infer on the influence of series. Parallel and single fan with R_A, R_B and R_C with help of a graph. **(08 Marks)**

Module-5

9 a. If Intake and return shafts are located close by at the centre of the property. Suggest the method of ventilation to be adopted with a neat sketch and explain the same. **(10 Marks)**

   b. Explain the steps in ventilation planning. **(06 Marks)**

OR

10 a. If Intake and return shafts are located far / at the two strike boundaries of the mine. Suggest the method of ventilation to be adopted with a neat sketch and explain the same. **(10 Marks)**

   b. Explain qualitative ventilation survey in a mine. **(06 Marks)**

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